Process for editing the Price-H Cost Product Spreadsheet

to support the customer's future work to refine their instrument concept and cost estimate

1. THE BASIS OF YOUR COST ESTIMATE: The IDL captures the *input* to your parametric cost estimate into an Excel spreadsheet of the mass model or Master Equipment List (MEL)
    a. The spreadsheet and the body of presentations from the study form the basis for the IDL's cost estimate, and it will have at a minimum 3 tabs
    b. ***YOUR INSTRUMENT***_**MEL** tab contains the component-level breakdown of your instrument structure, reflecting the mechanical hierarchy in the conceptual design
    c. The **Summary** tab captures the mass by subsystem, as computed by the data in the MEL tab, as well as the mass by assembly
    d. The **Cost Assumptions** tab captures your input the cost model, regarding schedule and build assumptions
    e. As needed, additional tabs will be created in the Excel spreadsheet MEL such as **FPGA Firmware**, and **FSW Input Sheet, FSW** for **SEER-SEM,** and **Optics**, which requires more parametric details than are captured in the MEL tab
2. The IDLs COST ESTIMATE: The IDL also captures your parametric cost estimate into an Excel spreadsheet
    a. The cost product spreadsheet is largely a static snapshot of the PRICE H cost model, so manipulation of the cost product requires that the customer team encode the information in order to recalculate totals
    b. For the cells in the cost spreadsheet that are encoded with formulas, we recommend that the customer take due diligence in following those formulas to recalculate totals
    c. The cost product spreadsheet will have at a minimum 2 tabs
    d. The **INSTRdetails** tab shows the component level lifecycle costs for every component the IDL team captured in the mass model; the hierarchy in the Excel cost product lines up directly with the mass model
    e. The **CostSummary** tab shows the top level summary costs that include instrument (or payload) wraps
    f. As needed, additional tabs will be created in the Excel spreadsheet for the cost product to capture other inputs and estimates generated by the IDL such as **SEER_SEM SW Estimate**, and **FSW Input Sheet**
3. UPDATING COMPONENT OR ASSEMBLY COSTS: In the Excel cost product for your instrument, in the worksheet tab ***YOUR INSTRUMENT***_**INSTRdetails**, you will find the detailed lifecycle costs for every item in the MEL – this is where component or assembly level changes should be executed.
    a. As your team refines and matures your design, you will naturally want to update your cost estimate to evaluate the impact – start with the INSTRdetails tab to edit components within assemblies

b. For example, in the INSTRdetails snapshot below, the assembly for the Data Handling Unit (DHU) on line 129 it broken down into components from line 130 to 136
c. If any one of the lines in that assembly are deleted or edited, the rack-up at the assembly level in line 129 needs to be recalculated to reflect the changes in the subassembly
d. Please note that the DHU I&T shown in line 137 was parametrically estimated for the assembly modeled and will not reflect the increase or decrease in I&T costs with the changes you make
e. We recommend you use your best judgment to scale I&T factors to scale the initial estimate in the direction of the changes made within the assembly
f. Please note that any changes to the INSTRdetails tab needs to be carried through the subtotal and grand totals in the INSTRdetails tab, and carried forward to the CostSummary tab as well

129	2	***Data Handling Unit (DHU)***	1	1				$3,538,349	Assembly
130	3	*Single Board Computer (Athena Power PC) (TRL-8)*	1	1	0.500	0.500		$308,748	ELECTRO / MECHANICAL
131	3	*I/O Module Board (One FPGA, TRL-5)*	1	1	0.500	0.500		$777,616	ELECTRO / MECHANICAL
132	3	*Memory Module (Gbit RAM) Board (TRL-8)*	1	1	0.500	0.500		$705,896	ELECTRO / MECHANICAL
133	3	*Heater Control Board (Qty:2, TRL-6)*	2	2	0.500	1.000		$450,825	ELECTRO / MECHANICAL
134	3	*Low Voltage Power Converter (LVPC) Board (TRL-7)*	1	1	0.500	0.500		$296,703	ELECTRO / MECHANICAL
135	3	*Backplane (TRL-7)*	1	1	0.600	0.600		$167,232	ELECTRO / MECHANICAL
136	3	*Housing (TRL-7)*	1	1	3.000	3.000		$178,197	STRUCTURAL / MECHANICAL
137	3	*DHU Integration & Test*	1	1			6.600	$653,131	INTEG & TEST

Fig 1 – Snapshot of INSTRdetails Tab

4. UPDATING INSTRUMENT OR PAYLOAD LEVEL COSTS: In the Excel cost product for your instrument, in the worksheet tab ***YOUR INSTRUMENT*_CostSummary**, you will find the top level summary costs that include instrument (or payload) wraps – this summary should be updated after any changes have been made at the component or assembly level
    a. Continuing the example illustrated previously, the new assembly cost for the DHU in line 19 in the CostSummary snapshot shown below should be updated with the results from the INSTRdetails worksheet (line 129)
    b. The top level payload total in line 8 of the CostSummary tab should be encoded to reflect the updated DHU costs by summing lines 9-23
    c. As with the assembly level I&T shown in the INSTRdetails tab, the instrument or payload level I&T costs shown in line 23 of the CostSummary tab reflect the parametric estimate with the as modeled DHU and will not necessarily capture the payload level I&T costs with the changes you have made
    d. We are confident that at this early stage, the cost differences at this summary level should be minimal, if the changes to the INSTRdetails tab were significant, we recommend you use your best judgment to scale I&T factors to scale the initial estimate in the direction of the changes made
    e. The instrument parametric summary in line 31 will need to be encoded to reflect the updated costs in line 8 – as you go to update the formula in line 31, note how the thru-put costs for the FPA in line 28 need to be folded in

the instrument sub-total and replicate that formula

2	Instrument Design Lab (IDL)Parametric Cost Estimate	Flight Units = 1
3		
4	(Development and Production Costs)	Cost Estimate (FY$11)
5	PRICE-H Cost Model Summary	
6		
7		
8	Payload (150.32 kg) Class B Electronics, GSFC Bid Rates, except as noted	$16,277,572
9	Camera Assembly (Group 1) (6.89 kg ea)(Qty:3) Contractor Bid Rates	$4,667,261
10	Camera Assembly (Group 2) (6.89 kg ea)(Qty:3) Contractor Bid Rates	$1,071,639
11	Camera Assembly (Group 3) (6.89 kg ea)(Qty:3) Contractor Bid Rates	$1,070,337
12	Moon Shade Assembly	$397,855
13	Camera Assembly Structure (CAS)	$1,432,855
14	Star Tracker Optical Heads, Hydra (Sodem) (Qty:2) Contractor Bid Rates	$0
15	Star Tracker Optical Heads Design Integration Support, Contractor Bid Rates	$76,997
16	Thermal Shield	$758,562
17	Telescope Back Thermal Close Out	$417,218
18	Payload Mounting Structure	$1,031,694
19	Data Handling Unit (DHU)	$3,538,349
20	Harness Subsystem	$185,427
21	Thermal Subsystem	$1,054,555
22	Misc Hardware (5%) (CME Qty:20) (TRL-7)	$101,884
23	Payload Integration & Test	$472,939
24		
25	PRICE-H Instrument Payload Estimate	$16,277,572
26		
27	Thruputs	$9,516,798
28	FPA Assembly and Camera Electronics ($9.5M)	$9,516,798
29		
30		
31	Instrument Subtotal with Thruputs, without Wraps and CM&O	$25,794,371

Fig 2 – Snapshot of CostSummary Tab

5. UPDATING INSTRUMENT OR PAYLOAD LEVEL COST WRAPS and FINAL TOTAL: In the same worksheet tab ***YOUR INSTRUMENT*** **_CostSummary**, you will need to also update the instrument level wraps to recalculate the total cost
    a. Note that the green section in the CostSummary tab has already been encoded; before making changes to the green instrument 'wraps' be sure to review how the sums were calculated so that the same rules apply
    b. For example, Flight Spares and ETU wraps (lines 46 & 47) are NOT applied to the customer-provided cost pass-thrus for the FPA Assembly & Camera Electronics in line 28, but GSE and Environmental Testing (lines 44 & 45) are applied to the Instrument Parametric Estimate in line 31, which does include FPA Assembly & Camera Electronics
    c. Note that the wraps are sometimes applied to a subset of the instrument assemblies; for example, CM&O in line 54 was NOT applied to out-of-house developments (lines 9-11 & 14-15) or to the FSW grassroots estimates – these are instrument-specific rules that applied to your specific build approach
    d. At the instrument or payload level, I&T is estimated as a percentage of the total instrument costs, and while the subassembly I&T cost for the DHU may not be accurate with changes made (and limited) to this assembly, at this level of fidelity, we are confident that the instrument level I&T is a reasonable estimate

31	Instrument Subtotal with Thruputs, without Wraps and CM&O	$25,794,371
32		
33		
34		
35	**The Following are NOT PRICE-H estimates but are derived from PRICE-H estimates. These are included for completeness and**	
36	**are considered ROM 'Grass-roots' estimates. Consult the Grass-roots estimating organization for a more accurate estimate.**	
37		
38		
39	Flight Software (SEER-SEM FSW Cost Estimate, Basis : IDL FSW Discipline SLOC Estimates)	$3,148,905
40	Flight Software (SEER-SEM FSW Sustaining Eng., Basis : IDL FSW Discipline SLOC Estimates)	$1,807,810
41	FSW Development Environment & Simulator SW (IDL Grassroots Cost Estimate)	$55,000
42	FSW Ground Support Equipment (FSW-GSE) (5% of FSW + 5% of FSW Development Env. Cost Estimates)	$159,945
43	FPGA Development (1 Uniques FPGAs @$400K ea + 3 Unique Algorithms @ $200k ea)	$1,000,000
44	Ground Support Equipment (GSE) (5% of Instrument Cost Estimate)	$1,289,719
45	Environmental Testing (5% of Instrument Cost Estimate)	$1,289,719
46	Flight Spares (5% of PRICE-H Instrument Cost Estimate as per customer direction)	$813,879
47	Engineering Test Unit (ETU) (10% of PRICE-H Instrument Cost Estimate)	$1,627,757
48	Instrument to S/C Bus Integration & Test (5% of Instrument Cost Estimate ($1,289,719), Typically Included in WBS 10.0)	<<<<< see information to left
49		
50		
51	**Instrument Subtotal with Wraps, without CM&O**	**$36,987,104**
52		

Fig 3 – Snapshot of CostSummary Tab with Instrument Level Wraps

6. REQUESTING AN UPDATED PARAMETRIC COST ESTIMATE: For customers that want an updated parametric cost estimate, please contact Bill Lawson/605 william.m.lawson@nasa.gov to discuss funding and scheduling for further work. We suggest that you edit and clearly highlight the spreadsheet cost product to capture the updates from your team. You can also use the following spreadsheet Customer Cost Input Sheet.xls that is in your final report folder (Additional Reference Documents).

Information Needed to Begin PRICE H Cost Modeling

Spacecraft Bus / Instrument Subsystem: <Enter Subsystem/Instrument Name>

(Complete for each Spacecraft Bus Subsystem and/or Instrument Subsystem)

Schedule Information	MMM-YY
Start - Phase A	
CDR	
End - Phase D	
Launch	

Provider (Indicate with 'X')	
GSFC In-House	
Contractor	
Other (name below)	

Component Name (Hierarchical/Indentured list as appropriate)	Quantity				Mass each (Kg) Current Best Estimate (CBE) (Do not include contigency/margin)	Composition (Structural: Al, composite, etc.; Electronic: analog, digital, A/D, or RF freq.; Optics: diam., material, surface prep, etc. Other: cabling, machined parts, motors, etc.)	(If purchased, i.e., COTS) Purchase Price (ea) ($)	TRL	Heritage
	Flight	EDU*	ETU**	Spares***					
Add rows as needed									

Level of detail needed:

Electronics: Identify at card level, Indicate analog, digital, or both, and any special ASICs/FPGAs

Mechanical: Identify individual mechanisms, optics, structural components, solar panels, comm. components, etc.

Optional:	*	EDU (Engineering Design Unit):	If qauntity not provided, default assumption is EDU QTY = 1
Optional:	**	ETU (Engineering Test Unit):	If quantity not provided, default assumption is ETU cost is 10% of Fight Hardware Cost
Optional:	***	Spares:	If quantity not provided, default assumption is ETU cost is 10% of Fight Hardware Cost

Fig 4 – Snapshot of Customer Cost Input Sheet